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ITEM OF INTEREST

Prepared by

Science and Technology Branch
Aerospace Information Division

SUBJECT: Air Purification in Confined Areas

SOURCES:
1. Mel'nikov, A. Kh., T. P. Firsova, and A. N. Molodkina. The synthesis of pure sodium peroxide and potassium superoxide. Zhurnal neorganicheskoy khimii, v. 6, no. 10, Oct 1961, 2225-2229. QD1.A3753, v. 6. (S/078/61/006/010)
2. Mel'nikov, A. Kh., and T. P. Firsova. The interaction of sodium superoxide with carbon dioxide in the presence of water vapor. Zhurnal neorganicheskoy khimii, v. 6, no. 10, Oct 1961, 2230-2236. QD1.A3753, v. 6 (S/078/61/006/010)
3. Mel'nikov, A. Kh., and T. P. Firsova. The interaction of sodium peroxide octahydrate with carbon dioxide. Zhurnal neorganicheskoy khimii, v. 6, no. 11, Nov 1961, 2470-2473. QD1.A3753, v. 6. (S/078/61/006/011)
4. Tsentsiper, A. B., and S. A. Tokareva. The interaction of carbon monoxide with superoxides of sodium or potassium. Zhurnal neorganicheskoy khimii, v. 6, no. 11, Nov 1961, 2474-2480. QD1.A3753, v. 6. (S/078/61/006/011)

The articles above were all submitted for publication on 15 Sep 1960, and deal with the synthesis and reactions of peroxides and superoxides of alkaline metals. In particular, reactions with carbon dioxide and carbon monoxide in the presence of moisture are investigated.

An improved method for obtaining the compounds by direct oxidation of metal with oxygen is reported in [1]. A nearly theoretical yield and great saving of time are claimed. The new method differs from previous ones in its direct use of pure oxygen under mild conditions from the beginning of the process and the careful metering of the oxygen throughout the process. Sintering of the end product is thereby avoided, and access of the oxygen to the surface of the oxidized metal is facilitated.

The oxidation process is carried out in two stages. The first stage takes place at oxygen pressures below atmospheric (6-8 mm Hg) and at relatively low temperatures (240-250°C for Na, 110-120°C for K). Duration of the reaction is only about 30 minutes. The second stage is conducted under atmospheric pressure of oxygen at temperatures not over 360°C for Na and not over 350°C for K. Duration of the reactions is 2-2.5 and 4-5 hours for Na and K, respec-

tively. Sodium peroxide is obtained as a friable product with a 100% yield. Some sintering is observed in the case of potassium superoxide, even at the prescribed temperature. The potassium superoxide is contaminated with 1-2% potassium peroxide and small amounts of silicates from corroded reactor glass.

The activity of the interaction of sodium superoxide with carbon dioxide is studied in [2]. Since previous studies have indicated that sodium superoxide does not react with dry $CO_2$, all experiments were made in the presence of water vapor at temperatures of -10, 0, +10, and 25°C. Interactions above 25°C were found to result in complete discharge of oxygen (both "peroxide" and "superoxide") and the formation of sodium carbonate over an intermediate phase of sodium hydroxide. Below 10°C only "superoxide" oxygen was discharged, while peroxide oxygen remained in the resultant compound, sodium peroxydicarbonate ($Na_2C_2O_6$). The $Na_2C_2O_6$ is formed over an intermediate phase of sodium peroxide hydrate, from which the water is completely split off.

A practical method of obtaining $Na_2C_2O_6$, which can be used as a mild oxidizer, is discussed in [3] and consists in direct synthesis from $CO_2$ and sodium peroxide octahydrate, which is produced from sodium hydroxide and hydrogen peroxide.

The interaction of sodium or potassium superoxide with carbon monoxide is described in [4]. Some differences in the reaction conditions for the sodium and potassium compounds with dry CO are revealed. The sodium compound reacts with dry CO only above 100°C, the temperature of dissociation of the superoxide, to form the sodium carbonate:

$$2NaO_2 + CO \longrightarrow Na_2CO_3 + O_2.$$

The process is accompanied by the formation of the peroxide:

$$2NaO_2 \longrightarrow Na_2O_2 + O_2.$$

Potassium superoxide on the other hand forms the carbonate with dry CO at only 95°C. In the presence of water vapor, the formation of sodium and potassium carbonate takes place at 95 and 70°C, respectively, through a stage of catalytic oxidation of CO, followed by the absorption of $CO_2$ by the alkali formed.

COMMENT:

The articles reported point to the continuation of Soviet studies on potential air-purifying agents for confined quarters, especially those agents producing additional oxygen from absorption of $CO_2$. (See also: AID Reports 60-59 and 61-42.) The question of CO absorption by alkali superoxides is of special interest in view of the reported presence of CO in exhaled air (See: AID Report 61-82).

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